CLAIMS

What is claimed is:

1. A method for producing a plurality of thin film actuators comprising:

a) Degassing a polymer film in a vacuum;

b) depositing a film of a shape memory alloy material onto the polymer film;

c) imparting a strain to the polymer film by 2 to 8% strain; and

d) cutting the polymer film to form a plurality of thin film actuators after the step of imparting a strain.

2. The method according to Claim 1 wherein the polymer film is a polyimide film.

3. The method according to Claim 1 wherein depositing a film of shape memory alloy is sputter coating a layer of shape memory alloy onto the polymer film.

4. The method according to Claim 1 wherein depositing a film of shape memory alloy is depositing a film of shape memory alloy selected from the group consisting of TiNiPd, TiNiAu, TiNiZr, TiNiHf, TiNiPt and combinations thereof.

5. The method according to Claim 1 wherein the step of imparting strain to the polymer film is imparting a uniaxial strain.

6. The method according to Claim 1 wherein the step of imparting a strain is imparting biaxial strain.

7. The method according to Claim 1 wherein the step of imparting a strain is done in a cyclic manner by heating and cooling under applied uniaxial or biaxial loading with the last cycle ending with strain applied in the fully martensitic condition.

8. The method of Claim 1 further comprising the step of exposing the shape memory alloy layer to a photo resist mask prior to cutting the polymer film into a plurality of actuators.

9. The method according to Claim 8 further comprising etching the shape memory alloy material prior to cutting the polymer film into a plurality of actuators.

10. The method according to Claim 1 further comprising layering portions of the film with a conductor.

11. The method according to Claim 10 wherein the conductor is between 1 and about 100 microns thick.

12. The method according to Claim 10 wherein the conductor is selected from the group consisting of Cu, Au, Ag, Ni, Cr and combinations thereof.

13. The method according to Claim 1 further comprising the step of annealing the shape memory alloy.

14. The method according to Claim 1 further comprising sputter coating a second layer onto the shape memory alloy layer.

15. The method according to Claim 14 wherein the second sputter coat is a conduction layer.

16. The method according to Claim 14 wherein the second layer is a plating assist layer.

17. A method for producing a plurality of thin film actuators comprising:

a) sputter deposing a film of a shape memory alloy material onto a polyimide film to form a shape memory alloy construction;

b) annealing the shape memory alloy construction;

c) imparting a 2 to 8% strain to the shape memory alloy construction; and

d) conducting a post straining process on the shape memory alloy construction after the step of imparting a 2 to 8% strain.

18. The method according to Claim 17 further comprising the step of cutting the shape memory alloy construction to form a plurality of thin film actuators after the step of conducting a post annealing process.

19. The method according to Claim 17 wherein the step of imparting strain to the polymer film is imparting a uniaxial strain.

20. The method according to Claim 17 wherein the step of imparting a strain is imparting biaxial strain.

21. The method according to Claim 17 wherein depositing a film of shape memory alloy is depositing a film of shape memory alloy selected from the group consisting of TiNiPd, TiNiAu, TiNiZr, TiNiHf, TiNiPt and combinations thereof.

22. The method of Claim 17 further comprising the step of exposing the shape memory alloy layer to a photo resist mask prior to cutting the polymer film into a plurality of actuators.

23. The method according to Claim 17 further comprising etching the shape memory alloy material prior to cutting the polymer film into a plurality of actuators.

24. The method according to Claim 17 wherein the step of imparting strain to the polymer film comprises the steps of:

placing the shape memory alloy construction over a die;

applying differential pressure into the die to deform the shape memory alloy construction.

25. The method according to claim 24 further comprising subjecting the shape memory alloy layer to ion irradiation to a depth of about one-half the thickness of the shape memory alloy layer.

26. The method according to claim 25 wherein subjecting the shape memory alloy layer to heavy ion irradiation is subjecting the shape memory alloy layer with heavy ions such as argon or krypton to damage the crystal structures to a degree that reverse transformation to the austenite is prevented.

27. The method according to claim 25 further comprising cutting the polymer film to form a plurality of thin film actuators after the step of imparting a strain.

28. The method according to claim 27 further comprising coupling two thin film actuators together to form a blister actuator.

29. A method for producing a plurality of thin film actuators comprising:

a) sputter deposing a film of a shape memory alloy material onto a polymer film to form a shape memory alloy construction;

b) imparting a 2 to 8% strain to the shape memory alloy construction.

30. The method according to claim 29 wherein the step of imparting strain to the polymer film is imparting a uniaxial strain.

31. The method according to claim 29 wherein the step of imparting a strain is imparting biaxial strain.

32. The method according to claim 29 further comprising etching the shape memory alloy film using a photolithographic method, wherein the polymer film is substantially unaffected by the photolithographic method.

33. The method according to Claim 32 further comprising the step of cutting the shape memory alloy construction to form a plurality of thin film actuators after the step of etching the shape memory alloy film.

34. An actuator comprising:

a pair of generally parallel actuator shape memory films deposited on a top surface of a polymeric substrate, the parallel actuator films being electrically coupled together by a conductor bridge disposed therebetween.

35. A blister valve comprising:

a first thin film member having a layer of shape memory alloy, the first thin film being plastically deformed to form a blister shape, the layer of shape memory alloy being subjected to heavy ion irradiation at an ion energy chosen to produce crystal lattice damage to a depth of about one-half the thickness of the layer of shape memory alloy; a first vent pore defined in the first film member;

a second member disposed generally parallel to the first thin member, said second member defining a second pore, said second pore being misaligned from the first pore; and

wherein first thin film member flattens upon heating and wherein when the first thin film member cooled, an outer elastic layer resets the blister.

36. The blister valve according to claim 35 wherein the second member is a second thin film member having a layer of second shape memory alloy, the second thin film being plastically deformed to form a blister shape, the second layer of shape memory alloy being subjected to heavy ion irradiation at an ion energy chosen to produce crystal lattice damage to a depth of about one-half the thickness of the second layer of shape memory alloy; the second vent pore defined in the second film member.

37. An actuator comprising:

a polymer film;

a shape memory film deposited on a top surface of a polymeric film, the shape memory film being is subjected to heavy ion irradiation at an ion energy chosen to produce crystal lattice damage to a depth of about one-half the thickness of the shape memory film.